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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/840,049 | 05/05/2004 | Boq-Kang Hwu | 67,200-763 | 6629 |

7590 04/28/2006

TUNG & ASSOCIATES
Suite 120
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Bloomfield Hills, MI 48302

EXAMINER

NHU, DAVID

| ART UNIT | PAPER NUMBER |
|----------|--------------|
|----------|--------------|

2818

DATE MAILED: 04/28/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/840,049

Applicant(s)

HWU ET AL.

Examiner

David Nhu

Art Unit

2818

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 May 2004.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 12-20 is/are allowed.
- 6) ☒ Claim(s) 1-3 and 5-11 is/are rejected.
- 7) ☒ Claim(s) 4 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

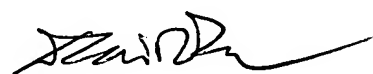
Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____



DETAILED ACTIONS

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-3, 5-11 are rejected under U.S.C 103(a) as being unpatentable Background of Invention (BOI) in view of Mui et al (2002/0127825 A1).

Regarding claim 1, BOI, (see pages 1-9), teaches a method for reducing or preventing contamination or oxidation of copper surfaces included in semiconductor process wafers comprising: providing a semiconductor wafer including copper features; placing the semiconductor wafer in a semiconductor wafer holding environment in queue for subsequent semiconductor manufacturing process.

BOI fails to teach providing a semiconductor wafer including copper features having newly formed surfaces following a semiconductor manufacturing process forming the newly formed process surfaces; exposing the process surfaces to an alkaline solution for a period of time sufficient to chemically modify the newly formed process surfaces prior to substantial exposure of the process surfaces to a contaminating or oxidizing atmosphere.

However, Mui, (see figure 1, see paragraph 011, 0024, 0025, 0027), teaches providing a semiconductor wafer including copper features having newly formed surfaces following a semiconductor manufacturing process forming the newly formed process surfaces; exposing the process surfaces to an alkaline solution for a period of time sufficient to chemically modify

the newly formed process surfaces prior to substantial exposure of the process surfaces to a contaminating or oxidizing atmosphere.

Regarding claim 2, BOI, (see pages 1-9), teaches manufacturing process includes at least one of copper CMP, copper seed layer deposition...

Regarding claim 3, BOI, (see pages 1-9), teaches providing a semiconductor wafer includes a semiconductor wafer having residual sulfur containing contaminants'

Regarding claims 4-5, Mui, (see figures 1-4, 6), teaches the alkaline solution includes deionized water and at least one ammonia free base including sodium hydroxide.

Regarding claims 7-8, Mui also teaches exposing the process surfaces to an alkaline solution includes at least one of a dipping and spraying process with simultaneous spinning of the semiconductor wafer.

Regarding claims 9-11, Mui teaches exposing the process surfaces to an alkaline solution with a period of time; placing the semiconductor wafer with an inert gas purge.

It would have been obvious to one having ordinary skill in the art at the time of the present invention to apply the teachings of Mui into the method of BOI as both are related to the same subject matter of providing a method of reducing or preventing contamination or oxidation of copper surfaces by applying an alkaline solution to expose the surfaces.

Allowable Subject Matter

3. Claims 12-20 are allowed.

Claims 4 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

Claim 4 includes allowable subject matter since the prior made of record and considered pertinent to the applicant's disclosure does not teach or suggest the claimed limitations.

Because BOI and Mui do not teach the alkaline solution has a pH of from about 7.5 to about 9.5 (as cited in claim 4); subjecting the exposed process surfaces substantially immediately following the semiconductor manufacturing process to an ammonia free alkaline solution for a period of time sufficient to at least partially hydroxylate the exposed process surfaces (as cited in claim 12).

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: Morita'247 is cited as of interest.

5. A shortened statutory period for response to this action is set to expired 3 (three) months from the date of this letter. Failure to respond within the period for response will cause the application to become abandoned (see 710.02 (b)).

8. Any inquiry concerning this communication on earlier communications from the examiner should be directed to David Nhu, (571)272-1792. The examiner can normally be reached on Monday-Friday from 7:30 AM to 5:00 PM. The examiner's supervisor, David Nelms can be reached on (571)272-1787.

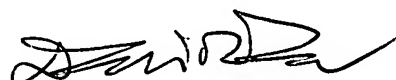
The fax phone number for the organization where this application or proceeding is assigned is (703)872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Art Unit: 2818

Information regarding the status of an application may be obtained from the patent application information retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

David Nhu



April 25, 2006